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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/772,115	01/26/2001	Eric Lee	IDT-1641	8988

27158 7590 06/12/2003

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EXAMINER

OWENS, DOUGLAS W

ART UNIT PAPER NUMBER

2811

DATE MAILED: 06/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application N .

09/772,115

Applicant(s)

LEE ET AL.

Examiner

Douglas W Owens

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 02 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 19-39 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 19-39 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 19, 20 and 39 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 19 and 39 require that the dielectric spacer have an upper surface that is silicon-rich. While there is disclosure for forming a dielectric spacer having a silicon implanted region in the upper surface of the dielectric spacer, there is no embodiment disclosed, wherein the dielectric spacer has an upper surface that is silicon-rich and includes a continuous silicide strap located thereon. It appears that the silicon-rich region shown in Figs. 2E – 2G is consumed when the silicide is formed by annealing the metal layer (218) to react with the implanted silicon, arriving at the embodiment shown in Fig. 2H. Additionally, while that is disclosure for using silicon-rich dielectric spacers, there is no disclosure with respect to the upper surface still being silicon-rich after the anneal step. It stands to reason that much of the excess silicon would have been incorporated into the silicide layer formed during the anneal step.

Claims 20 and 39 further require that the portion of the dielectric spacer located away from the upper surface of the dielectric spacer is not silicon-rich. The written specification does not disclose such an embodiment. The specification only discloses a device including a silicide strap, wherein the dielectric spacer is not silicon rich. With respect to an excess of silicon near the surface of the dielectric spacer, there is no disclosure of this region being silicon-rich after the anneal step of forming the silicide.

***Claim Rejections - 35 USC § 102***

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 21, 23, 26-30 and 33-36 are rejected under 35 U.S.C. 102(b) as being anticipated by US patent No. 5,387,535 to Wilmsmeyer.

Regarding claim 21, Wilmsmeyer teaches a semiconductor structure (Fig. 11) comprising:

- a semiconductor substrate (1);
- a conductive element (7) located over the substrate;
- a dielectric spacer (6) adjacent the sidewall of the conductive element;
- a semiconductor region (Col. 2, lines 45 – 50 (conductive element is polysilicon)) scattered in the upper surfaces of the conductive element; and
- a continuous silicide strap (10, 101) directly contacting the conductive element, the dielectric spacer and the semiconductor substrate.

Regarding claims 26 and 33, Wilmsmeyer teaches a semiconductor structure, wherein the silicide strap comprises a refractory metal layer (4, 41) reacted with semiconductor material (5, 51). Wilmsmeyer does not teach that the semiconductor

material is in the conductive element. This is considered a product-by-process limitation. "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claims 23 and 27, Wilmsmeyer teaches a semiconductor structure, wherein the semiconductor material comprises amorphous silicon (Col. 2, lines 48-50; Col. 3, lines 19-21).

Regarding claims 28 and 34, Wilmsmeyer teaches a semiconductor structure, wherein the conductive element is a gate electrode.

Regarding claims 29 and 35, Wilmsmeyer teaches a semiconductor structure, further comprising a gate dielectric (22).

Regarding claims 30 and 36, Wilmsmeyer teaches a semiconductor structure, further comprising a source/drain region (31, 32), wherein the silicide strap contacts the source/drain region.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 22, 24, 25, 31, 32, 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilmsmeyer.

Regarding claims 31 and 37, Wilmsmeyer does not explicitly teach a dielectric spacer comprising silicon oxide or silicon nitride. Wilmsmeyer is silent with respect to the material that is selected for the spacers. The use of silicon oxide and silicon nitride for dielectric spacers is old in the art. It would have been obvious to one of ordinary skill in the art to select silicon oxide or silicon nitride since they are known materials that are well suited for the intended use.

Regarding claims 32 and 38, Wilmsmeyer teaches a semiconductor structure, wherein the silicide strap comprises a silicide made from a heat-resistant metal (Col. 1, lines 29 – 32). Wilmsmeyer does not explicitly teach a silicide strap comprising cobalt silicide. It would have been obvious to one of ordinary skill in the art to select cobalt for the refractory metal silicide, since cobalt is a heat-resistant metal that is known and well suited for the intended use.

Regarding claim 22, Wilmsmeyer does not teach a semiconductor device, wherein the dielectric spacer is silicon-rich. Silicon-rich oxides and nitrides are known and used in the art for several advantages, such as superior etch selectivity as compared to stoichiometric dielectric layers, as well as better protective properties. It would have been obvious to one of ordinary skill in the art incorporate a silicon-rich dielectric into the device taught by Wilmsmeyer since the properties described above are desirable and silicon-rich dielectrics is a known material that is well suited for the intended use.

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Regarding claims 24 and 25, Wilmsmeyer does not teach a semiconductor structure, wherein the semiconductor region is implanted. It is well known in the art to implant areas of silicon where a change in conductivity is desired. It is a foundational principal in semiconductive devices. It would have been obvious to one of ordinary skill in the art to implant the silicon to achieve the desired conductivity, or to further reduce the resistivity of the silicide strap.

### ***Response to Arguments***

6. Applicant's arguments filed April 2, 2003 have been fully considered but they are not persuasive.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). With respect to the use of a silicon-rich sidewall spacer, as stated above, the use of silicon rich dielectrics is well known in the art, for advantages outside of those disclosed in the instant application. See for example, US patent No. 6,054,394 to Wang, where silicon-rich sidewall spacers (324) are used for the purpose of preventing undesired etching to the bit line comprising polysilicon (307) and silicide (308). See also, US patent No. 5,940,714 to Lee et al. and US patent No. 6,159,833 to Lee et al., where silicon-rich

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dielectric sidewalls are used. The Applicant further argues that disadvantages of using a silicon-rich dielectric spacer have been ignored in making the case of obviousness. The silicon-rich dielectric is known and used in the art for sidewall spacers. The selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Additionally, although there may be disadvantages stemming from using a silicon-rich dielectric spacer, there are also disadvantages that stem from using stoichiometric silicon dioxide or nitride. However, there is a reasonable expectation of success in using silicon-rich dielectric material, as evidenced in the prior art.

The Applicant argues that Wilmsmeyer does not teach "a refractory metal layer reacted with semiconductor material in...the dielectric spacer". Wilmsmeyer teaches reacting a silicon layer and refractory metal layer to form the silicide. It is agreed that Wilmsmeyer does not teach forming the silicide strap by reacting refractory metal with semiconductor material in the element, spacer and substrate. This is considered a product-by-process limitation. "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).



The Applicant argues that Wilmsmeyer does not teach a semiconductor region dispersed in the upper surfaces of the conductive element. The conductive element taught by Wilmsmeyer comprises polysilicon (Col. 2, lines 45 – 48), a semiconductive material. The entire upper surface of the conductive element has a semiconductor region dispersed throughout, since all of it is semiconductive material.

***Conclusion***

***Conclusion***

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

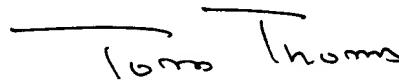
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W Owens whose telephone number is 703-308-6167. The examiner can normally be reached on Monday-Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

DWO  
June 9, 2003

A handwritten signature in black ink that reads "Tom Thomas". The signature is written in a cursive style with a horizontal line above the first name.

TOM THOMAS  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800